

WHAT IS CLAIMED IS:

1. A method for measuring a thickness of a film on a substrate comprising:

directing a jet of a light-transmitting liquid towards said film to form a column of the light-transmitting liquid reaching said film;

directing a light through said column of the light-transmitting liquid towards said film;

receiving the light reflected from said film through said column of said light-transmitting liquid; and

measuring the thickness of said film upon receipt of said light reflected from said film.

2. An apparatus for measuring a thickness of a film on a substrate comprising:

a first conduit the tip end of which is directed to and spaced away from said film, said first conduit discharging a jet of a light-transmitting liquid from said tip end thereof towards said film to form a column of the light-transmitting liquid extending between said tip end of the first conduit and said film;

a light emitter for emitting a light toward said film through said column of the light-transmitting liquid; and

a light receiver for receiving the light reflected from said film through said column of said light-transmitting liquid to enable measurement of the thickness of said film on the basis of said light reflected from said film.

3. An apparatus as set forth in claim 2 in which

said light emitter comprises an optical fiber the tip end of which is directed to said film to direct the light towards said film through said column of said-transmitting liquid.

4. An apparatus as set forth in claim 2 in which

said light receiver comprises an optical fiber the tip end of which is directed to said film to receive the light reflected from said film through said column of said-transmitting liquid.

5. An apparatus as set forth in claim 2 in which

said light emitter comprises an optical fiber the tip end of which is directed to said film to direct the light towards said film through said column of said light-transmitting liquid, and

said light receiver comprises an optical fiber the tip end of which is directed to said film to receive the light reflected from said film through said column of said light-transmitting liquid.

6. An apparatus as set forth in claim 5, in which said optical fibers of said light emitter and said light receiver are integrally formed.

7. An apparatus as set forth in claim 2 in which said first conduit is provided with a light transmitting member liquid-tightly separating the inside and outside of the first conduit,

said light emitter comprises an optical system provided outside said first conduit and optically connected to said first conduit so as to direct a light from said optical system through said light transmitting member provided on said first conduit so that the optical system directs the light through said first conduit and said column of said light transmitting liquid.

8. An apparatus as set forth in claim 2 further comprising:

a second conduit inside which said first conduit is positioned, said second conduit receiving the light-transmitting liquid which has impinged on said film and spread radially.

9. An apparatus as set forth in claim 8, in which said second conduit is connected to a pump to draw said light transmitting liquid spread radially.

10. An apparatus for treating a substrate bearing a film on the surface of the substrate comprising:

a holder for holding a semiconductor wafer; and

a film thickness measurement device comprising:

a first conduit the tip end of which is directed to and spaced away from said film, said first conduit discharging a jet of a light-transmitting liquid from said

tip end thereof towards said film to form a column of the light-transmitting liquid extending between said tip end of the first conduit and said film, the diameter of the column being uniform;

a light emitter for emitting a light toward said film through said column of the light-transmitting liquid; and

a light receiver for receiving the light reflected from said film through said column of said light-transmitting liquid to enable measurement of the thickness of said film on the basis of said light reflected from said film.

11. An apparatus as set forth in claim 12 in which said light emitter comprises an optical fiber the tip end of which is directed to said film to direct the light towards said film through said column of said-transmitting liquid.

12. An apparatus as set forth in claim 10 in which said light receiver comprises an optical fiber the tip end of which is directed to said film to receive the light reflected from said film.

13. An apparatus as set forth in claim 10 in which said light emitter comprises an optical fiber the tip end of which is directed to said film to direct the light towards said film through said column of said-transmitting liquid, and

said light receiver comprises an optical fiber the tip end of which is directed to said film to receive the light reflected from said film.

14. An apparatus as set forth in claim 13, in which said optical fibers of said light emitter and said light receiver are integrally formed.

15. An apparatus as set forth in claim 10 further comprising:

a second conduit inside which said first conduit is positioned, said second conduit receiving the light-transmitting liquid has impinged on said film and radially spread.

16. An apparatus as set forth in claim 15, in which

said second conduit is connected to a pump to draw said light transmitting liquid spread radially.

17. An apparatus as set forth in claim 15 in which

said apparatus comprises a turntable having a polishing surface and a substrate holder for keeping a substrate in contact with said polishing surface to polish the substrate;

said first and second conduits are provided through said turntable;

said second conduit opens at the polishing surface so as to be sealed from the outside thereof by the polishing surface engaged with said substrate; and

said first conduit has said tip end spaced from said substrate engaging with said polishing surface.

18. An apparatus as set forth in claim 17 in which

there are provided a plurality of sets of said first and second conduits.

19. An apparatus for polishing a substrate comprising:

a turntable having a polishing surface and an axis for rotation;

a substrate holder for holding a substrate provided with a film on its surface with said film engaged with said polishing surface; and

a film thickness measurement device comprising:

a light emitter for emitting a light toward said

film:

a light receiver for receiving the light reflected from said film to enable measurement of the thickness of said film on the basis of said light reflected from said film; and

an optical system having an optical path extending through said turntable from the center of said turntable to a predetermined radial position in said turntable, said optical path including a proximal end opening in the polishing surface and extending axially and a distal end opening in said polishing surface at said predetermined radial position so that the light from said light emitter is introduced into said optical path through said proximal

end, lead to said distal end and directed to the film and the light reflected from said film is returned to said proximal end to exit the optical path to enable said optical receiver to receive said reflected light.